

*CYCLOLEBERIS CHRISTIEI*, A NEW SPECIES OF MARINE  
OSTRACODA (SUBORDER MYODOCOPINA) FROM  
SALDANHA BAY AND LANGEBAAN LAGOON, SOUTH AFRICA

Louis S. Kornicker and Rosalie F. Maddocks

*Abstract.*—Kornicker, L. S., Department of Invertebrate Zoology, Smithsonian Institution, Washington, D.C. 20560, and R. F. Maddocks, Department of Geology, University of Houston, Houston, Texas 77004.—*Cycloleberis christiei*, a new species of marine Ostracoda (Suborder Myodocopina) from Saldanha Bay and Langebaan Lagoon, South Africa, is described and illustrated, and the ontogeny and variability of the species is discussed.

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Saldanha Bay and Langebaan Lagoon form a connected bay-lagoonal complex about 24 km in length along the western coast of South Africa about 106 km north of Cape Town. The northern part, Saldanha Bay, is open to the Atlantic Ocean, whereas Langebaan Lagoon, a shallow lagoon, is open to Saldanha Bay at its northern end but is separated from the ocean by a narrow peninsula along its western shore. For map of the bay and lagoon see Day (1959: fig. 1).

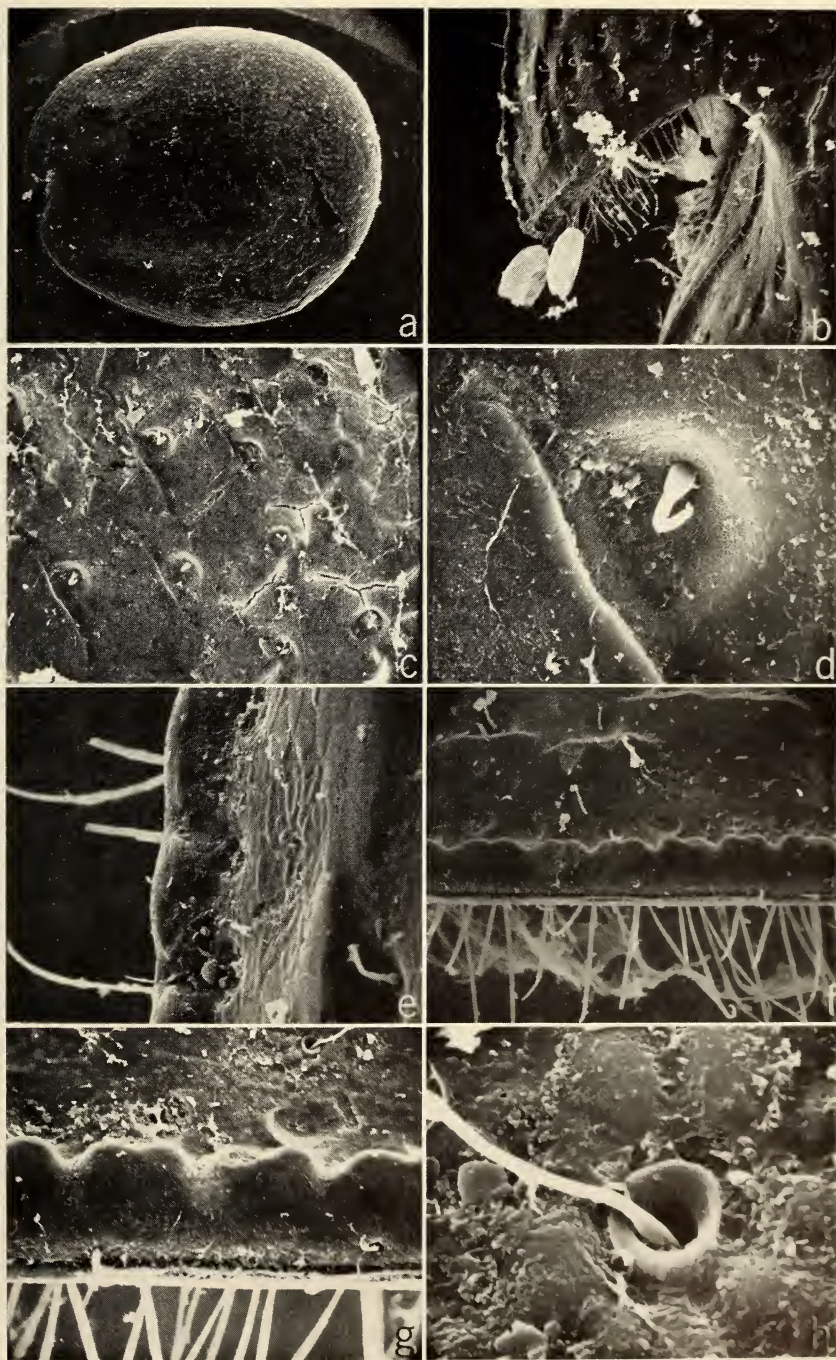
According to Day (1959:486) surface water temperatures range from 13.9°C in winter to 16.9°C in summer in Saldanha Bay, while at the southern end of Langebaan Lagoon the annual range is 9.9°C–24.0°C; salinities in Saldanha Bay range from 34.62–34.91‰, and are as low as 32.66‰ in the southern part of Langebaan Lagoon after a winter rain.

The specimens upon which this study is based are from individual collections made by Drs. John H. Day, Nigel Christie, and Anton Moldan, all of the Zoology Department, University of Cape Town, Rondebosch, South Africa. We are indebted to them for making the material available.

The new species described herein brings to 3 the number of species of the genus *Cycloleberis* reported to be living along the western coast of Africa. In the description of this species we include information concerning its ontogeny and variability.

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Fig. 1. *Cycloleberis christiei*, holotype USNM 157334, ovigerous female, outside views of left valve: a, Complete valve, length 5.0 mm; b, Rostrum and incisor, note attached protozoans,  $\times 50$ ; c, Oblique ridges and fossae containing bristles on antero-ventral valve surface,  $\times 300$ ; d, Detail from c,  $\times 1,500$ ; e, Scalloped ridge along anterior margin of rostrum, from b,  $\times 620$ ; f, Anterior view of valve showing scalloped marginal ridge and bristles,  $\times 240$ ; g, Detail from f,  $\times 540$ ; h, Detail of pore and bristle near middle of f,  $\times 3,500$ . Micrographs reduced to 55% for publication.





The holotype and paratypes of the new species have been deposited at the National Museum of Natural History, Smithsonian Institution. Five paratypes have also been sent to Dr. John H. Day, University of Cape Town.

We are grateful to Anne Cohen, Smithsonian Institution, for reviewing our manuscript.

CYLINDROLEBERIDIDAE Müller, 1906

CYCLASTEROPINAE Poulsen, 1965

*Cycloleberis* Skogsberg, 1920

*Cycloleberis christiei*, new species

Figs. 1-7

*Cycloleberis galathea* Poulsen, 1965:260, fig. 89. [juvenile ♂ paratype from Beira, Mozambique, not holotype from False Bay, South Africa. Referral is considered questionable].

*Etymology*.—The species is named for Dr. Nigel Christie, who supplied some of the specimens described herein.

*Distribution*.—Saldanha Bay, at depths of 5-24 m in mud, fine silt, fine sand, shell and sand, and coarse shell and sand. Langebaan Lagoon, at depths ranging from intertidal to 7 m in muddy sand, silt and sand, fine sand, medium sand, sand among rocks, sand and gravel, and coarse shelly sand.

*Holotype*.—USNM 157334, ovigerous female on slides and in alcohol.

*Type-locality*.—Langebaan Lagoon, South Africa, sta. LB 601M, 17 Feb. 1975, 33°07'S, 18°01'12"E, 3.5 m, fine sand.

*Paratypes*.—Langebaan Lagoon: Sta LB 184, 26 April 1949, 33°12'S, 18°05'E, intertidal, muddy sand: USNM 157292, 157336, 157364—1 adult ♂ and 2 adult ♀. Sta LB 218, 26 April 1949, 33°12'S, 18°05'E, intertidal, muddy sand: USNM 157347—1 adult ♀. Sta LB 230, 12 Dec. 1950, 33°07'S, 18°03'E, intertidal, sand among rocks: USNM 157293, 157294, 157324—3 A-1♂, USNM 157361—1 adult ♂. Sta LB 240, 2 May 1951, 33°07'S, 18°03'E, depth and substrate unrecorded, probably intertidal: USNM 157295—1 A-2♂, USNM 157296—1 A-1♂, USNM 157327—1 A-3♂, USNM 157406—1 A-1♀. Sta LB 241J, 2 May 1951, 33°07'S, 18°03'E, depth unrecorded, probably intertidal, sand among rocks: USNM 157335, 157337, 157338, 157339—4 adult ♀, USNM 157350, 157358—2 A-1♀, USNM 157333—1 A-2♂, USNM 157328, 157329—2 A-3♂, USNM 157346, 157354, 157355, 157356, 157357, 157359—7 juv. ♀. Sta LB 243, 2 May 1951, Sandy Point, intertidal, sand: USNM 157362—1 adult ♀. Sta LB 267, 3 May 1951, 33°07'S, 18°03'E, depth and substrate unrecorded, probably intertidal: USNM 157353—1 A-1♀, USNM 157322—1 A-2♂, USNM 157360—1 juv. ♀. Sta 409, 6 Dec. 1953, 33°04'S, 18°02'E, intertidal, sand: USNM 157349—1 A-1♀, USNM 157297—1 A-2♂, USNM 157407—1♀. Sta LB 447Q, 1 May

1954, 33°07'S, 18°03'E, depth and substrate unrecorded, probably intertidal: USNM 157340, 157344—2 adult ♀, USNM 157331—1 A-3♂, USNM 157323—1 A-1♂, USNM 157330—1 A-3♂, USNM 157341, 157342—2 A-1♀, USNM 157343—1 juv. ♀. Sta LB 448G, 1 May 1954, 33°07'S, 18°03'E, intertidal: USNM 157291—1 adult ♂, 157363, 157351—2 adult ♀, USNM 157299, 157325—2 A-2♂, USNM 157326, 157332—2 A-3♂, USNM 157345, 157348, 157352—3 juv. Sta LB 474, 8 May 1955, 33°07'S, 18°03'E, intertidal, sand: USNM 157298—1 A-1♂. Sta LB 577N, 15 Dec. 1974, 33°06'54" S, 18°01'48"E, 4.5 m, fine sand: USNM 157390—3 spec. Sta LB 578D, 15 Dec. 1974, 33°07'S, 18°01'12"E, 3.5 m, fine sand: USNM 157392—7 spec. Sta LB 579P, 15 Dec. 1974, 33°06'06"S, 18°01'06"E, 4.5 m, fine sand: USNM 157388—1 spec. Sta LB 582J, 20 Dec. 1974, 33°05'24"S, 18°09'E, 4.5 m, silt and sand: USNM 157386—5 spec. Sta LB 585G, 19 Dec. 1974, 33°05'12"S, 18°04'E, 7 m, sand and gravel: USNM 157391—1 spec. Sta LB 588H, 17 Dec. 1974, 33°05'24"S, 18°00'E, 2.1 m, medium sand: USNM 157387—1 spec. Sta LB 589H, 16 Dec. 1974, 33°08'30"S, 18°03'54"E, 2.1 m, fine sand: USNM 157389—1 spec. Sta LB 591E, 18 Feb. 1975, 33°05'42"S, 18°01'12"E, 3 m, silt and sand: USNM 157380—1 juv. Sta LB 593J, 18 Feb. 1975, 33°05'30"S, 18°00'04"E, 6.5 m, sand and gravel: USNM 157385—1 spec. Sta LB 596G, 18 Feb. 1975, 33°05'24"S, 18°00'E, 2.1 m, medium sand: USNM 157394—2 spec. Sta LB 597F, 20 Feb. 1975, 33°05'54"S, 18°01'24"E, 5 m, coarse shelly sand: USNM 157383—9 spec. Sta LB 598F, 17 Feb. 1975, 33°06'06"S, 18°01'06"E, 4.5 m, fine sand: USNM 157382—41 spec. Sta LB 599E, 17 Feb. 1975, 33°06'18"S, 18°01'36"E, 5.8 m, medium sand: 5 specimens sent to Dr. John H. Day, University of Cape Town. Sta LB 600P, 17 Feb. 1975, 33°06'54"S, 18°01'48"E, 4.5 m, fine sand: USNM 157384—7 spec. Sta LB 601M, 17 Feb. 1975, (type-locality): USNM 157381—46 specimens. Sta LB 602F, 17 Feb. 1975, 33°08'24"S, 18°02'06"E, 7 m, fine sand: USNM 157379—1 adult ♂. Sta LB 603F, 18 Feb. 1975, 33°08'30"S, 18°03'54"E, 2.1 m, fine sand: USNM 157378—1 adult ♂. Sta LB 604N, 20 Feb. 1975, 33°09'30"S, 18°04'24"E, 3.1 m, fine sand: USNM 157396, 46 specimens. Sta LB 605J, 20 Feb. 1975, 33°09'30"S, 18°05'06"E, 2 m, fine sand: USNM 157393—25 spec. Sta LB 591E, LB 602F, LB 603F (combined samples)—USNM 157290—2 adult ♂, 157318, 157319—2 adult ♂, USNM 157377—3 spec.

Saldanha Bay: Sta SB 295V, 30 April 1963, 33°03'54"S, 18°00'30"E, 14 m, fine sand: USNM 157401—4 spec. Sta SB 297K, 30 April 1963, 33°03'54"S, 18°00'30"E, 14 m, fine sand: USNM 157399—1 spec. Sta SB 308V, 30 April 1963, 33°03'42"S, 18°00'49"E, 13 m, mud: USNM 157398—1 spec. Sta SB 310V, 1 May 1963, exact locality not recorded, 5 m, coarse sand and shell: USNM 157400—4 spec. Sta SB 350L, 29 April 1964, 33°02'54"S, 18°01'36"E, 13 m, shell and sand: USNM 157397—1 spec. Sta SB 410F, 12 April 1975, 33°00'21"S, 17°57'18"E, 5 m, fine sand: USNM 157395—1 juv. Sta SB



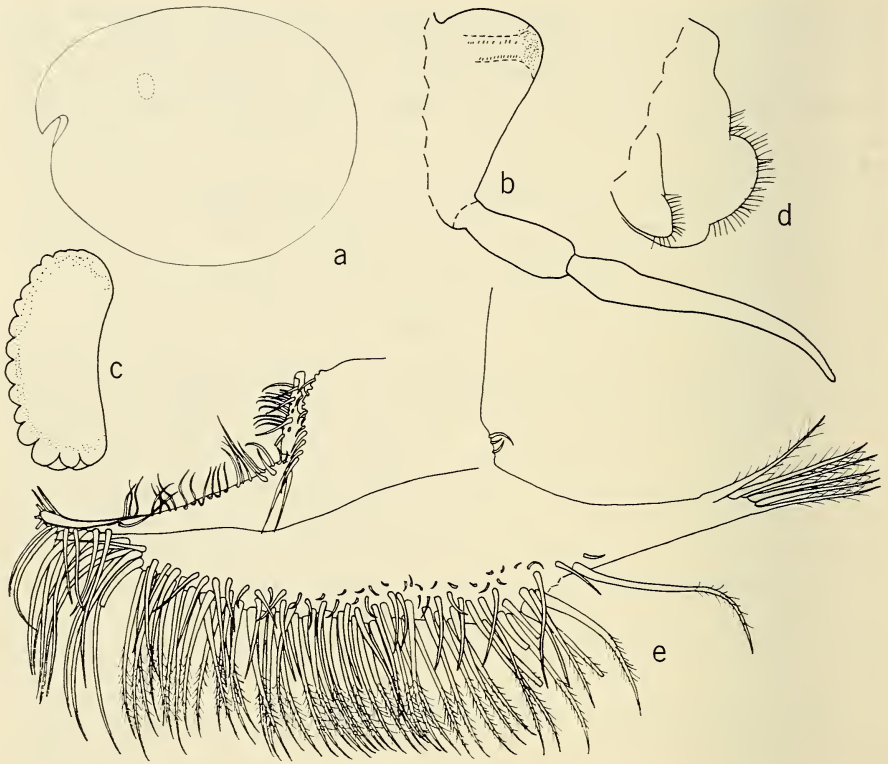


Fig. 2. *Cycloleberis christiei*. a-d, Holotype, USNM 157334, ovigerous female: a, Complete specimen, length 5.0 mm; b, Medial eye and rod-shaped organ; c, Outline of right lateral eye; d, Upper lip, anterior to right. e, Paratype, adult female, USNM 157364, 6th limb.

411C, 4 July 1975, 33°03'07"S, 17°58'05"E, 24 m, fine silt: USNM 157405—1 juv. Sta SB 413C, 4 July 1975, 33°03'S, 18°57'54"E, 9 m, fine silt: USNM 157402—1 spec. Sta SB 419C, 4 July 1975, 33°00'05"S, 17°57'09"E, 9 m, fine silt: USNM 157404—1 spec. Sta SB 429B, 4 July 1975, 33°01'00"S, 18°00'00"E, 15 m, fine silt: USNM 157403, 1 juv.

*Description of adult female.*—Carapace similar to that of adult female of *Cycloleberis squamiger* (Scott, 1894) (see Kornicker, 1975:4), but slightly larger (Figs. 1, 2a).

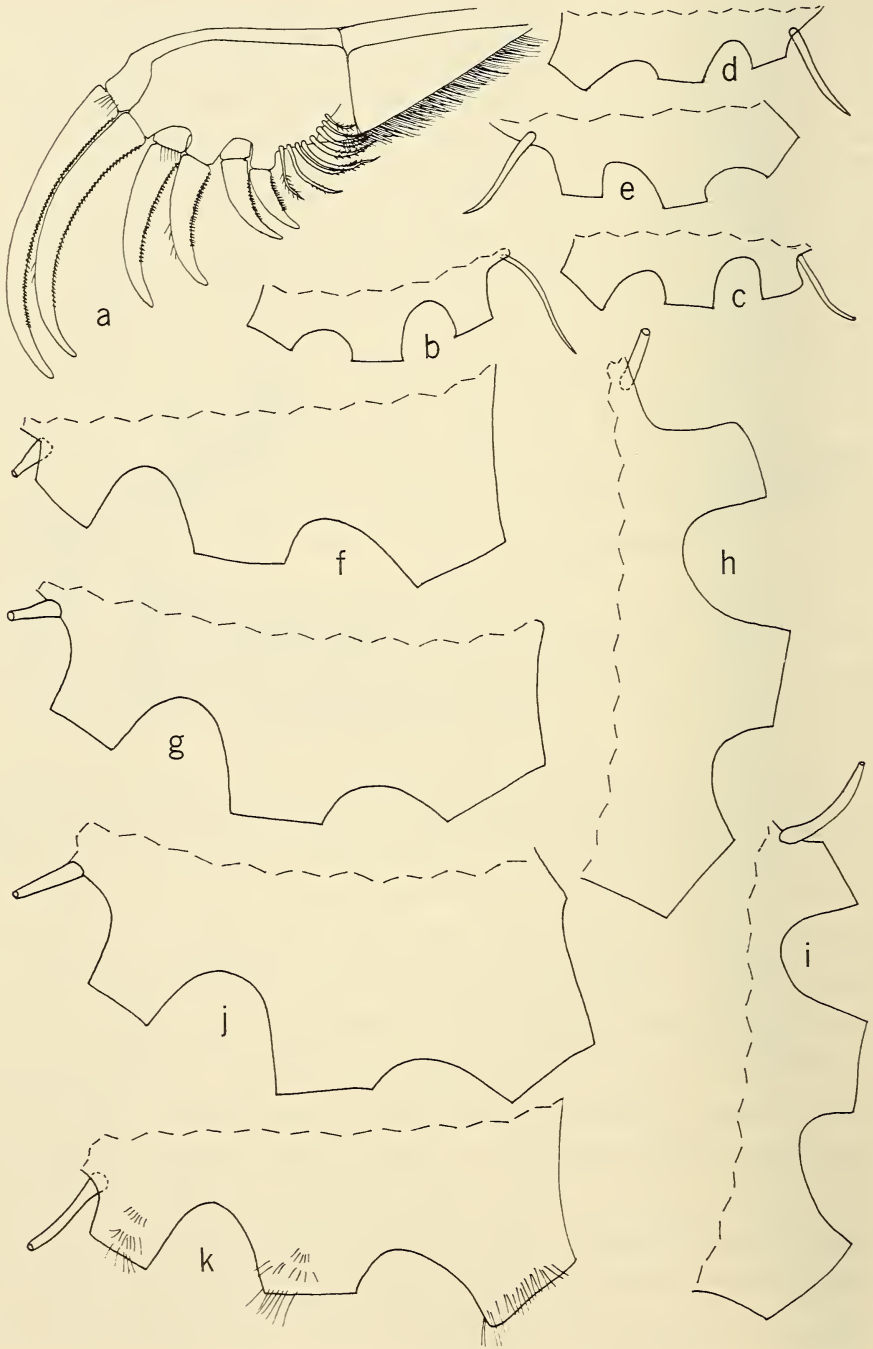
Size in mm: USNM 157334, length 5.0, height 4.0; USNM 157335, length 5.0, height 4.0; USNM 157336, length 5.0, height 3.9; USNM 157337, length 4.9, height 3.9; USNM 157338, length 4.9, height 3.9; USNM 157339, length 4.9, height 3.8; USNM 157340, length 4.8, height 3.9.

First antenna: 1st joint: medial surface with long hairs proximally near

middle, on ventral half all along joint, and distally on dorsal half of joint. 2nd joint: medial surface with long proximal hairs near dorsal margin and shorter hairs near ventral and terminal margins; lateral surface with long hairs near ventral margin and 9 distal bristles with short marginal spines; dorsal margin with 6 bristles (proximal 3 of these bare, or with short spines, others with long marginal spines). 3rd joint: long dorsal margin with 14 spinous bristles; short ventral margin with 1 short bristle with short marginal spines. 4th joint: ventral margin with 4-5 spinous terminal bristles (inner of these small); dorsal margin with 1 long spinous bristle. Sensory bristle of 5th joint with 2 short proximal filaments and 12 or 13 longer distal filaments. 6th joint short, with few medial spines and 1 long, stout, medial bristle reaching well past a-claw of 7th joint. 7th joint: a-claw about same length as 5th joint, bare with rounded tip; b-bristle about same length as sensory bristle of 5th joint, with about 11 filaments; c-bristle reaching past tip of sensory bristle, with about 14 filaments. 8th joint: d- and e-bristles bare, about same length as sensory bristle, almost twice length of a-claw; f-bristle bent dorsally, about same length as b-bristle, with about 10 filaments; g-bristle slightly shorter than c-bristle, with about 15 filaments.

Second antenna (Fig. 7b): Protopodite: medial surface, ventral and dorsal margins with long hairs (more abundant ventrally). Endopodite 3-jointed: 1st joint with 9-13 proximal bristles and 5 or 6 distal bristles; 2nd joint with 0-2 bristles; 3rd joint with 1 long terminal bristle (for distribution of bristles on 7 specimens see Table 3). Exopodite: medial surface of 1st joint with minute short straight terminal bristle; minute faint spines present along ventral and dorsal margins (not observed on all limbs); all bristles with natatory hairs; bristles of joints 2-8 and 3 long bristles of 9th joint with well developed spines, much larger than those of adult male; 9th joint with 5 bristles, dorsal of these short; joints 4-8 with basal spines increasing in length on distal joints; basal spine of 8th joint about half length of 9th joint; lateral spine of 9th joint about same length as basal spine of 8th joint; lateral and dorsal margins of joints 2-8 with short spines forming row (long dorsal hairs present on adult male, absent on female).

Mandible: Coxale endite similar to that of adult male. Basale: endite with about 7 bristles near end (one of the bristles much longer than others), a row of 16 triaenid bristles along ventral margin, and 21 dwarf bristles near dorsal margin (the most distal of these longer and stouter than others); ventral margin of basale with 13 triaenid bristles and 1 long distal bristle with long proximal and short distal spines; 2 proximal and 2 distal (almost terminal) dwarf bristles present on medial side close to ventral margin; dorsal margin of basale with 19 short bristles (distributed all along margin) and 2 long spinous terminal bristles; medial surface with long hairs distributed similarly to those of adult male, and short spines forming rows





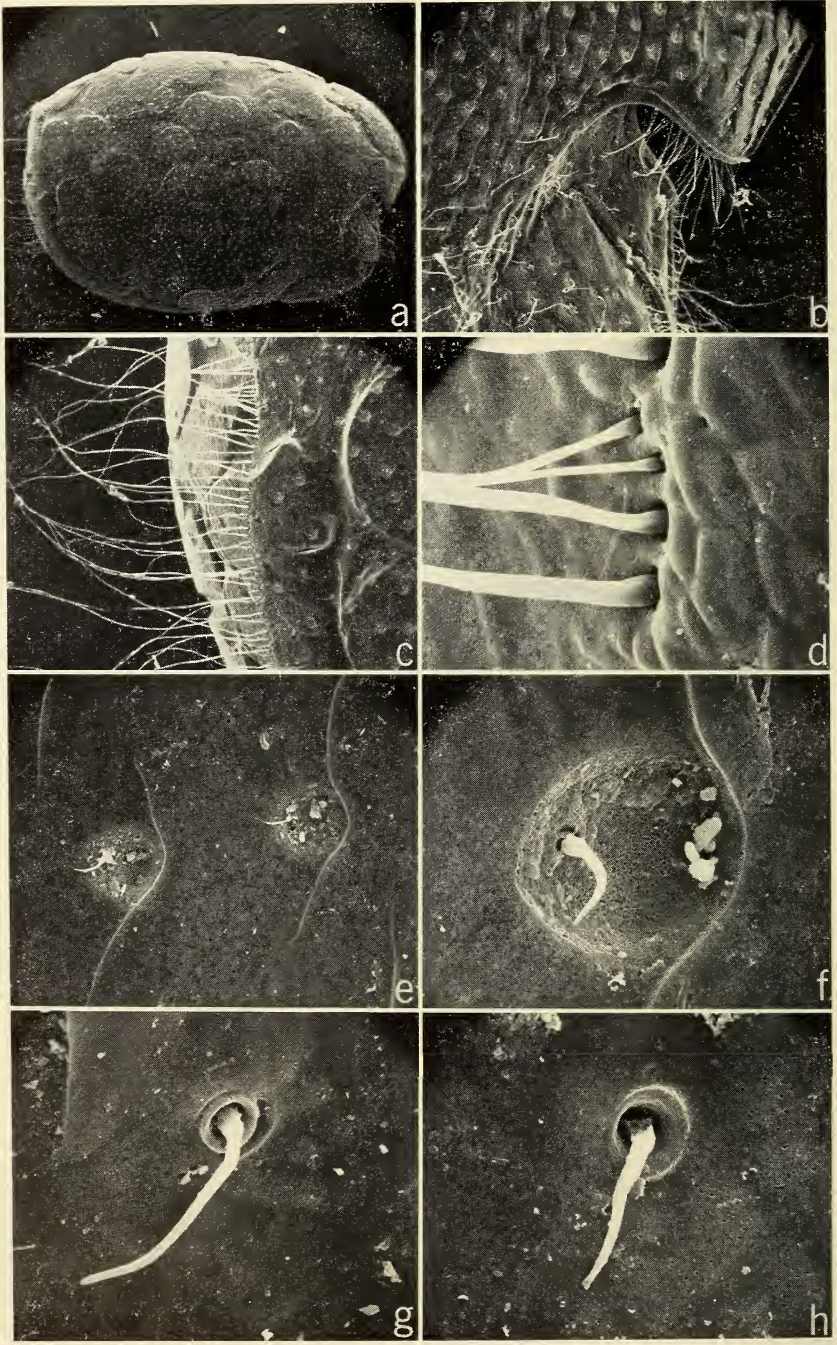
near dorsal margin. Exopodite hirsute, extending just past distal end of 1st endopodial joint, with 2 ventral bristles, both with short, faint, marginal spines (distal bristle extending just past tip of exopodite, proximal bristle about twice length of distal bristle). Endopodite: 1st joint with 9 spinous ventral bristles (2 of these small); dorsal margin and medial surface (near dorsal margin) of 2nd joint with numerous bristles; ventral margin with 4 spinous subterminal bristles (bases on medial surface) and 2 long spinous terminal bristles; claws and bristles of end joint similar to those of adult male.

Maxilla: Epipodite and endites similar to those of adult male. Basale: lateral side with 1 short proximal bristle near middle; 11 short bristles present on medial side just distal of, and dorsal to, bases of bristles of endite III; medial side near dorsal margin with 17–20 subequal proximal bristles; distal dorsal margin with 1 long bristle with short, faint, marginal spines, and 10 or 11 short bare bristles; ventral margin with medial row of 23–25 short bristles (proximal of these longer than distal) followed by 1 long and 2 medium length spinous bristles, and 1 long spinous terminal bristle; medial side with 7–12 short distal bristles forming row; dorsal margin of basale hirsute; hairs also present on medial surface. Exopodite consisting of minute lobe with 3 bristles (2 short, 1 longer, reaching past middle of 1st endopodial joint). Endopodite: 1st joint hirsute, with 1 short, bare, bristle near middle of anterior margin, and 1 long beta-bristle with short marginal spines; end joint with 6 bristles with short marginal spines.

Fifth limb: Dorsal margin of comb slightly convex, hirsute, with 9–11 proximal small bristles. Lateral side of comb with 1 long, stout, spinous bristle anterior to 1 long, slender, spinous bristle; 3 or 4 minute bristles present between the 2 long bristles (bases of minute bristles close to base of the long slender bristle); 6 short bristles present near ventral margin of comb in vicinity of base of long slender bristle; 2 short spinous bristles present near ventral margin at anteroventral corner of comb. Ventral margin of comb with 3 rows of spinous bristles (middle row longer than medial and lateral rows), except for anterior 15 bristles which form single row.

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Fig. 3. *Cycloleberis christiei*, furca. a–c, Paratype, USNM 157336, adult female: a, Left lamella and main claws of right lamella; b, c, Medial view of part of right lamella and lateral view of part of left lamella showing concavities between main claws and position of 1st secondary claw. d, e, Holotype, USNM 157334, ovigerous female, lateral views of parts of left and right lamellae. f, g, Paratype, USNM 157318, adult male, medial view of part of left lamella and lateral view of part of right lamella. h, i, Paratype, USNM 157292, adult male, medial view of part of right lamella and lateral view of part of left lamella. j, k, Adult male from station LB 447Q, specimen lost, lateral view of part of right lamella and medial view of part of left lamella.





Sixth limb (Fig. 2e): 1-3 bristles in place of epipodial appendage, remaining bristles of limb not counted, but limb appearing similar to that of adult male.

Seventh limb: Each limb with about 117 bristles, 53-64 bristles on each side; each bristle with up to 8 bells; most rings with 2 bristles, 1 on each side, but many distal rings with 4 bristles, 2 on each side. Terminus with opposing combs, each with about 28 pectinate bristles of several types.

Furca (Fig. 3a-e): Number and distribution of claws similar to those of adult male; depth of concavity in lamella between main claws 1 and 2, 30-55% of greatest width; depth of concavity between claws 2 and 3, 59-93% of greatest width.

Rod-shaped organ (Fig. 2b): Elongate, broadening posterior to suture (suture proximal to middle) and then tapering to rounded tip.

Eyes: Lateral eye pigmented, well developed with about 70 ommatidia (5 rows, each with about 14 ommatidia), about  $\frac{2}{3}$  length of lateral eye of adult male (Fig. 2c). Medial eye pigmented (Fig. 2b), about same size as lateral eye, and about same size as medial eye of adult male.

Posterior of body and upper lip (Fig. 2d): Similar to those of adult male.

*Description of adult male.*—Carapace similar to that of adult male of *Cycloleberis squamiger* (Scott, 1894) (see Kornicker and Caraion, 1974:47), but slightly larger (Figs. 4, 5a).

Size: USNM 157318, length 5.5 mm, height 3.8 mm; USNM 157319, length 5.5 mm, height 3.8 mm; USNM 157290, 2 adult males, length 5.3 mm, height 3.8 mm, length 5.3 mm, height 3.8 mm.

First antenna (Figs. 5b, 6a): 1st joint with medial and lateral hairs near ventral margin (not shown in Fig. 6a). 2nd joint: dorsal margin with 4 or 5 bare bristles; lateral surface with 8 bare bristles; medial surface with long proximal hairs near dorsal margin. 3rd joint: long dorsal margin with 13 spinous bristles (not all bristles shown on illustrated limb); short ventral margin with 1 short bare bristle. 4th joint: ventral margin with 5 spinous terminal bristles (inner of these very small); dorsal margin with 1 long, spinous, terminal bristle. Sensory bristle of small 5th joint with abundant filaments (about 9 terminal filaments stouter than others). Medial bristle of small 6th joint bare, about equal in length to combined lengths of joints

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Fig. 4. *Cycloleberis christiei*, paratype, USNM 157319, adult male, outside views of right valve: a, complete valve, length 5.5 mm; b, Rostrum and incisur,  $\times 100$ ; c, Posterior end of valve showing bristles forming vertical row, fossae containing small bristle, and short curved ridges below fossae,  $\times 100$ ; d, Detail of bases of bristles forming vertical row, from c,  $\times 1,000$ ; e, Detail of fossae and ridges, from b,  $\times 650$ ; f, Detail from b,  $\times 2,000$ ; g, h, Pores bearing bristles on anteroventral part of valve, g,  $\times 2,000$ , h,  $\times 3,000$ . Micrographs reduced to 55% for publication.



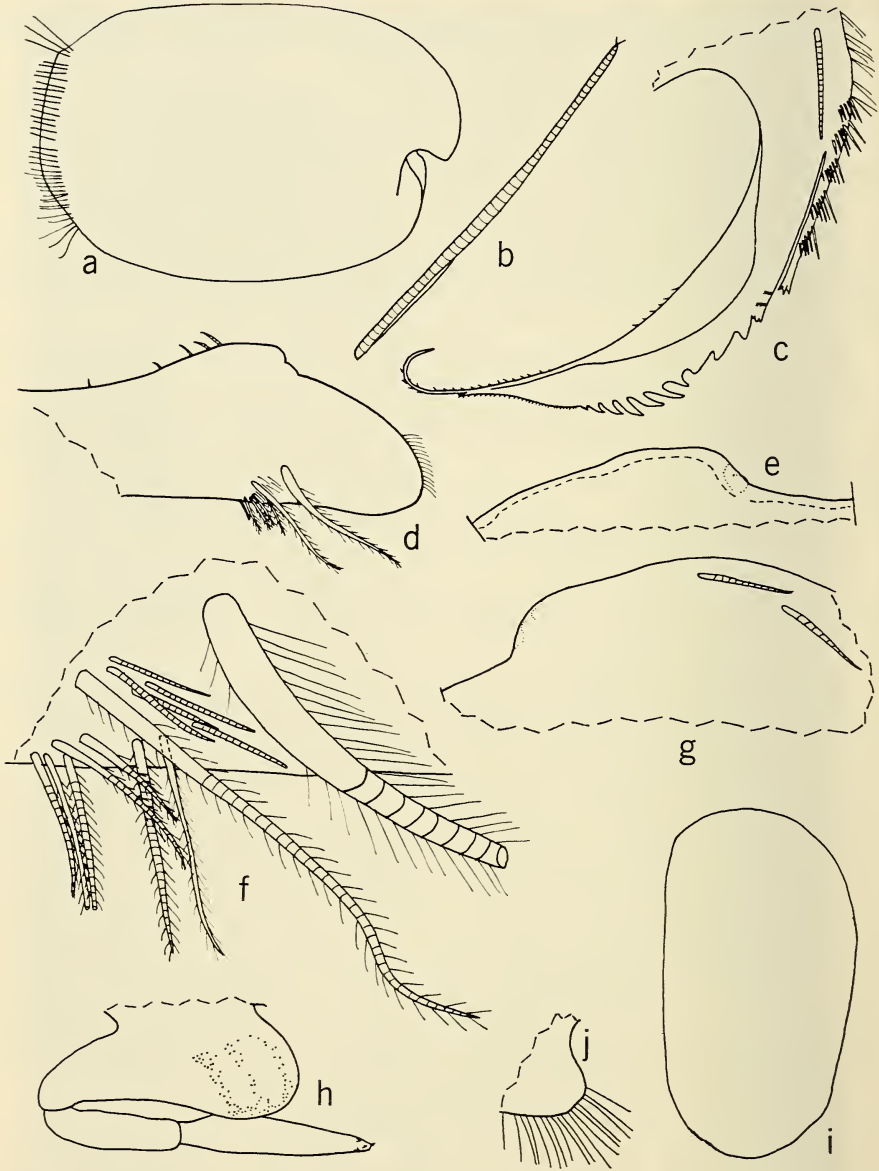


Fig. 5. *Cycloleberis christiei*, paratype, USNM 157318, adult male: a, Complete specimen, length 5.5 mm; b, Proximal filament on f-bristle of 1st antenna; c, Medial view of coxale endite of left mandible; d, Lateral view of comb of right 5th limb; e, Detail of dorsal margin in d; f, Detail of bristles near ventral margin in d; g, Lateral view of process and 2 bristles on dorsal margin of comb of left 5th limb, anterior to left; h, Medial eye and rod-shaped organ; i, Outline of left lateral eye; j, Anterior end of right lobe of upper lip.

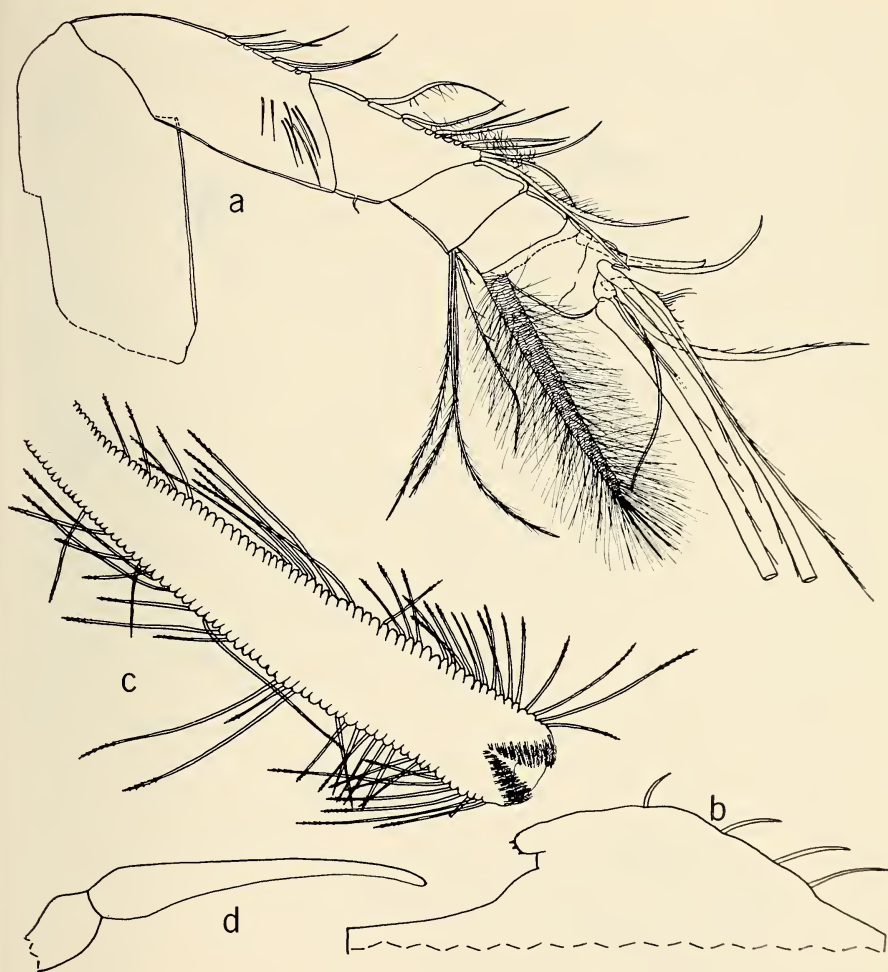


Fig. 6. *Cycloleberis christiei*, adult male. a, Lateral view of right 1st antenna of specimen from station LB 447Q, specimen lost. b-c, Paratype, USNM 157292: b, Lateral view of process on dorsal margin of left 5th limb; c, 7th limb. d, Paratype, USNM 157318, distal part of rod-shaped organ.

4-8. 7th joint: a-claw bare, with base on small pedestal; b-bristle about  $3\frac{1}{2}$  times length of a-claw, with about 15 short marginal filaments (extreme tip missing on illustrated specimen); c-bristle very long, tip missing on specimen examined, remaining part with about 40 short filaments. 8th joint: d- and e-bristles well developed, longer than a-claw (1 of these with tip missing on illustrated appendage); f-bristle very long, extreme tip missing on specimen examined, remaining part with about 46 short filaments

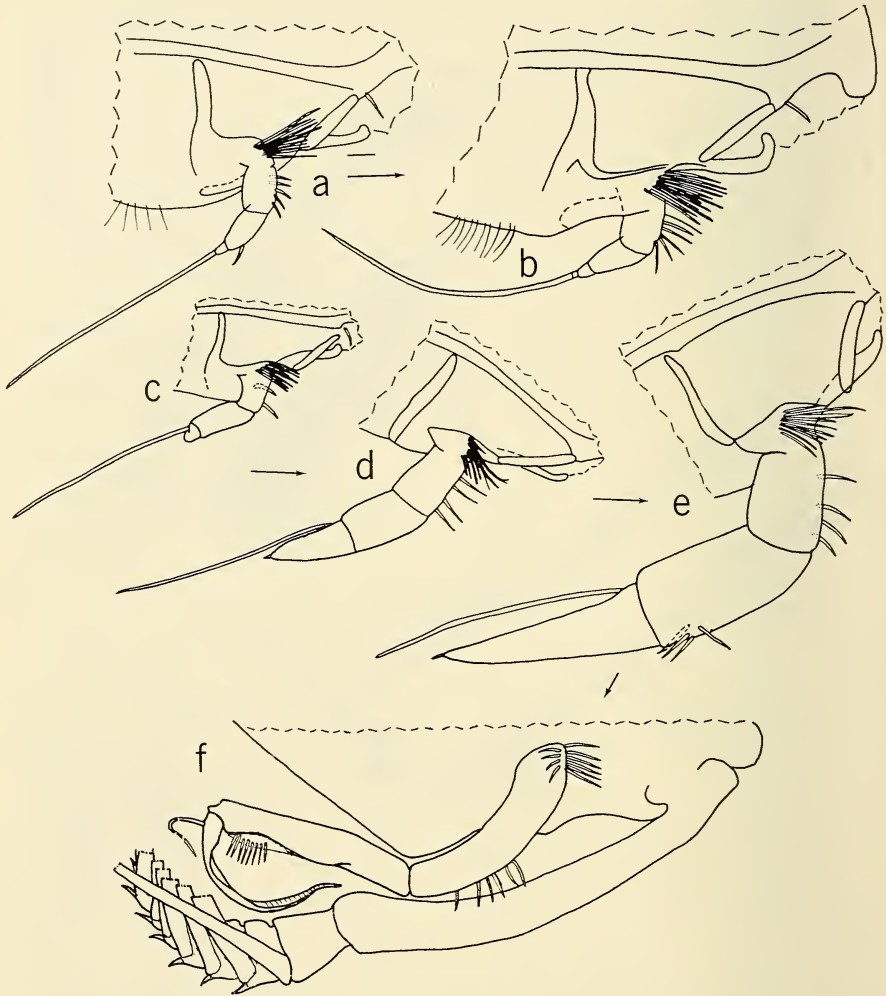


Fig. 7. *Cycloleberis christiei*. a-b, Developmental stages of endopodite of female 2nd antenna: a, Paratype, USNM 157341, A-1 instar; b, Holotype, USNM 157334, ovigerous female. c-f, Developmental stages of endopodite of male 2nd antenna, all paratypes: c, USNM 157327, A-3 instar; d, USNM 157295, A-2 instar; e, USNM 157293, A-1 instar; f, USNM 157318, adult.

(proximal filaments with narrow transparent flange); g-bristle about 6 times length of a-claw, with 8 closely spaced proximal filaments followed by 16 more widely spaced filaments.

Second antenna (Fig. 7f): Protopodite bare except for small distomedial bristle. Endopodite 3-jointed: 1st joint elongate, with 6-12 short proximal



bristles and 4-6 short distal bristles along ventral margin; 2nd joint elongate with 8 or 9 short distal bristles; 3rd joint elongate, reflexed, with 1 medium proximal bristle and serrations along inner margin of distal half of joint. Exopodite: elongate 1st joint with minute medial terminal bristle and minute spines forming rows near ventral margin; joints 3-8 with basal spines of similar length on all joints; basal bristle of 8th joint about equal in length to length of 9th joint, but smaller on some specimens; lateral spine of 9th joint about same length as basal spine of 8th joint; bristles of joints 2-8 with minute spines and natatory hairs; 9th joint with 5 bristles (dorsal of these short) with natatory hairs, some of the longer bristles may have minute spines; proximal ventral margin of bristle of 5th joint with minute spines (visible only under oil immersion); dorsal terminal corner of joints 2-8 with long hairs forming row; shorter hairs forming row along middle of distal margins of lateral side of joints 2-8.

Mandible: Coxale endite (Fig. 5c): ventral branch with proximal spines on ventral margin followed by spines forming 5 or 6 oblique rows (no club-formed or finger-formed spines as on ventral branch of endite of *C. galathea* described by Poulsen, 1965:262); tip of branch with 3 teeth (inner tooth with blunt tip bearing minute spines); ventral margin of dorsal branch with 4 processes pointing distally followed by 7 processes pointing proximally (the last of these very small); tip of dorsal branch more prolonged than that illustrated for *C. galathea* by Poulsen (1965:261, Fig. 87g) and terminating with minute spine; posterior bristle with base just proximal to the minute terminal spine and with few short hairs; dorsal margin of dorsal branch with hairs proximal to base of posterior bristle and with few spines just distal to middle of branch; slender bristle present near base of ventral branch. Basale: endite with 2 long stout bristles and about 8 shorter bristles near distal end, a row of 8 triaenid bristles near ventral margin, and 14 dwarf bristles along dorsal margin (the most distal of these longer and stouter than others); ventral margin of basale with 9 triaenid bristles and more distally 2 spinous bristles (the proximal of the spinous bristles only slightly longer than the triaenid bristles, and with short marginal spines; the distal of the spinous bristles, long, stout, with long proximal and short distal spines); 2 dwarf bristles present in distal ventral corner; dorsal margin of basale with 14 short distal bristles and 2 long spinous terminal bristles; medial surface of basale with long hairs. Hirsute exopodite extending just past distal margin of joint, with 2 bare bristles along ventral margin (proximal of these extending only short distance past tip of distal bristle). Endopodite: 1st joint with 9 spinous ventral bristles (1 of these minute); dorsal margin and dorsal half of medial side of 2nd joint with numerous bristles (about 65); ventral margin of 2nd joint with 6 terminal bristles; end joint with 3 long stout claws and 3 bristles (1 long, lateral, 2 short ventral).

Maxilla: Epipodite pointed, bare. Protopodite only weakly divided into 3 endites: endite I with 3 long and 2 short bristles; endite II with 2 long and 1 short or medium bristle; endite III with 4 long bristles. Basale: 9 short bristles present on medial side just distal and dorsal to bases of bristles of endite III; medial side near dorsal margin with 10–13 subequal but fairly short proximal bristles; distal dorsal margin with 1 long spinous bristle and 7 or 8 short bristles; ventral margin with medial row of 18 minute bristles followed by 3 medium length bristles, and then 1 long terminal bristle; medial side with 8 or 9 short distal bristles forming row; dorsal margin of basale hirsute. Exopodite consisting of minute lobe with 3 bristles (2 short, 1 fairly long, with marginal hairs). Endopodite: 1st joint hirsute, with 1 short bare bristle near middle of anterior margin, and 1 long beta-bristle with short marginal spines; end joint with 6 bristles, some with short marginal spines.

Fifth limb (Figs. 5d–g, 6b): Dorsal margin of comb with single rounded process; minute and variable structures present on anterior edge of process; 5 or 6 small bristles present on dorsal margin of comb proximal to anterior edge of dorsal process. Lateral surface of comb: 1 long, stout, spinous bristle present anterior to 1 long, slender, spinous bristle; 5 minute bristles present between the 2 long bristles; about 7 short bristles present near ventral margin of comb in vicinity of base of long slender bristle; 2 short bristles present near ventral margin at anteroventral corner of comb. Hairs absent from dorsal margin of comb except on anterior edge where numerous. Ventral margin of comb with 3 rows of spinous bristles (bristles of middle row longer than those of medial and lateral rows), except for anterior 12 or 13 bristles which form single row (bristles not shown in illustrations). Comb without strong internal sclerotization reported for comb of male *Cycloleberis squamiger* (Scott, 1894) by Kornicker and Caraion (1974:56, 57, 58, Figs. 30a, 31h).

Sixth limb: Medial side of anterodorsal corner of protopodite with about 9 minute, broad spines and more slender spines forming several rows; medial side of anterior margin proximal to upper suture with spinous bristles forming 3 rows (inner row with 19 bristles, middle row with 17 bristles longer than bristles in inner row, outer row with 24 bristles more slender and slightly longer than bristles in inner row but shorter than those in middle row); medial side of anterior margin between upper and lower sutures with 4 bristles in inner row, 1 bristle in middle row, and 6 bristles in outer row; about 17 bristles forming row along anterior edge between lower suture and anteroventral corner of skirt; ventral edge of skirt with numerous long and short bristles; posterior end of skirt with 5 or 6 hirsute bristles; 3 short bare bristles in place of epipodial appendage; limb hirsute.

Seventh limb (Fig. 6c): Each limb with about 97 bristles, 48–49 bristles on each side; each bristle with 2–8 bells; most rings with 2 bristles,

1 on each side; some distal rings with up to 4 bristles, 2 on each side. Terminus with opposing combs, each with about 25 pectinate bristles of several types.

**Furca (Fig. 3f-k):** Each lamella with 3 stout claws followed by 8 (rarely 9) bristlelike secondary claws; 1st and last secondary claws slightly shorter and more slender than other secondary claws; 1st secondary claw on left lamella close to base of 3rd main claw, on right lamella separated by space from 3rd main claw; concavity between 1st and 2nd main claws shallower than that between 2nd and 3rd claws; depth of concavity in lamella between main claws 1 and 2, 26–44% of greatest width; depth of concavity in lamella between main claws 2 and 3, 59–68% of greatest width; main claws with medial and lateral row of teeth along posterior margin, teeth about same length; 1st and last secondary claws with closely spaced fine teeth, other secondary claws with more widely spaced coarse teeth proximally and fine closely spaced teeth distally; main teeth with few hairs on or near anterior margins; medial hairs present at bases of main claws; a fringe of hairs present along edge of lamellae following secondary claws.

**Rod-shaped organ:** Elongate, broadening posterior to suture near middle and then tapering to rounded tip (Fig. 6d). Rod-shaped organ of USNM 157318 aberrant having short distal segment with teeth at tip (Fig. 5h).

**Eyes:** Lateral eye pigmented, well developed with about 67 ommatidia (5 rows, each with 11–14 ommatidia) (Fig. 5i). Medial eye pigmented, smaller than lateral eye (Fig. 5h).

**Posterior of body:** Hirsute but without dorsal process.

**Upper lip (Fig. 5j):** Each lobe hirsute but without spines.

**Ontogeny and variability.**—In order to be able to compare the appendages of the new species with those of *Cycloleberis galathea* Poulsen, which is known only from juveniles, ontogenetic changes and variability were studied in selected characters (number of filaments on the sensory bristle of the 1st antenna, number of bristles on the endopodial joints of the 2nd antenna, and number of distal bristles on the dorsal margin of the basale of the maxilla) of the adult male and female of *C. christiei*, as well as on the A-1 to A-3 instars of the male, and the A-1 instar of the female. The presence of bristles on the 7th limb of the A-3 male indicates that it is not younger than a stage IV instar (see Kornicker, 1969:3).

**Sensory bristle of 5th joint of 1st antenna (Table 1):** The sensory bristle of the A-3 male bears 2 short proximal and 7 or 8 long distal filaments. The sensory bristle of the A-2 male bears 2 short proximal and 10 long distal filaments. The sensory bristle of the A-1 male bears 2–4 short proximal and 10–12 long distal filaments. The adult male bears abundant filaments of which about 9 terminal filaments are thicker than the others. The sensory bristles of the A-1 female and the adult female bear 2 short proximal filaments. The sensory bristles of the A-1 female bear 7–12 and of the adult



Table 1. Number of filaments on sensory bristle of 1st antennae and on distal dorsal margin of maxilla of females and males. (nd—no data, na—not applicable.)

	Sensory bristle of 1st antenna				Distal dorsal margin of basale of maxilla	
	Proximal (short)		Distal (long)			
	Left	Right	Left	Right	Left	Right
Adult females						
USNM 157334	2	2	13	nd	nd	12
157340	nd	2	nd	12	nd	12
157336	2	2	13	12	10	11
A-1 females						
157341	2	2	12	12*	nd	nd
157342	nd	2	nd	7	nd	8
Adult males						
157318	na	na	na	na	7	9
157292	na	na	na	na	7	8
A-1 males						
157324	2	nd	nd	10	7	nd
157294	nd	3	nd	12	8	nd
157323	3	nd	12	nd	8	nd
157293	4	nd	12	nd	7	nd
A-2 male						
157295	2	2	10	10	6	6
A-3 males						
157326	nd	nd	nd	nd	nd	4
157330	nd	2	nd	8	nd	5
157331	nd	2	nd	7	nd	4

\* proximal of the distal bristles with space between its base and base of 11 remaining bristles.

female bear 12 or 13 long distal filaments. The sensory bristle of the A-1 male bears more short proximal filaments than the sensory bristles of the adult and A-1 females.

Endopodite of male 2nd antenna (Table 2): In instars examined younger than the A-3 instar, the male and female could not be discriminated. The endopodite of the A-3 male (Fig. 7c) bears 5-8 short proximal and 2-3 short distal bristles on the 1st joint, no bristles on the 2nd joint, and 1 long subterminal bristle on the smaller 3rd joint (a minute spinelike terminal bristle was found on the 3rd joint of 1 of the 7 limbs examined). The subterminal position of the bristle on the 3rd joint is the basis for

Table 2. Number of bristles on endopodial joints of 2nd antennae of males. (nd—no data.)

Specimens (length, width in mm)	First joint				Second joint				Third joint								
	Proximal		Distal		Left		Right		Left		Right		Left		Right		
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	
<b>Adult males</b>																	
USNM 157318 (5.5, 3.8)	12	10	6	6	9	8	1	1	1	1	0	0	0	0	0	0	0
157319 (5.5, 3.8)	6	6	4	4	8	8	1	1	1	1	0	0	0	0	0	0	0
157291 (nd)	nd	8	nd	5	nd	8	nd	1	1	nd	1	nd	0	nd	0	0	0
157292 (nd)	10	nd	5	nd	8	nd	1	nd	1	nd	0	0	0	0	nd	nd	nd
<b>A-1 males</b>																	
157293 (4.2, 3.2)	10	nd	4	nd	4	nd	1	nd	1	nd	1*	1*	1*	nd	nd	nd	nd
157294 (4.5, 3.2)	11	nd	5	nd	5	nd	1	nd	1	nd	1*	1*	1*	nd	nd	nd	nd
157296 (4.5, 3.5)	nd	10	nd	4	nd	4	nd	1	1	nd	1	nd	1*	nd	1*	nd	1*
157298 (4.6, nd)	8	nd	3	nd	4	nd	1	nd	1	nd	1†	1†	nd	nd	nd	nd	nd
157323 (4.5, 3.6)	nd	10	nd	4	nd	4	nd	1	1	nd	1	nd	1*	1*	1*	1*	1*
157324 (nd)	6	nd	5	nd	4	nd	1	nd	1	nd	1*	1*	1*	nd	1*	nd	nd
<b>A-2 males</b>																	
157295 (3.5, 2.9)	8	nd	4	nd	0	nd	1	nd	1	nd	1*	1*	1*	nd	nd	nd	nd
157297 (3.5, 2.7)	nd	11	nd	4	nd	1	nd	1	1	nd	1	nd	1*	1*	1*	1*	1*
157299 (3.6, 2.8)	7	nd	4	nd	1	nd	1	nd	1	nd	1*	1*	1*	nd	nd	nd	nd
157322 (nd)	8	nd	3	nd	1	nd	1	nd	1	nd	1*	1*	1*	nd	nd	nd	nd
157325 (nd)	8	nd	4	nd	1	nd	1	nd	1	nd	1*	1*	1*	nd	nd	nd	nd
157333 (3.5, 2.8)	nd	9	nd	nd	nd	1	nd	1	1	nd	1	nd	1*	1*	1*	1*	1*
<b>A-3 males</b>																	
157326 (2.9, 2.1)	nd	8	nd	3	nd	0	nd	1	1	nd	1	nd	0	nd	nd	0	0
157327 (2.8, 2.2)	7	nd	2	nd	0	nd	1	nd	1	nd	1	nd	0	nd	0	nd	nd
157328 (2.8, 2.2)	nd	6	nd	2	nd	0	nd	1	1	nd	1	nd	0	nd	0	0	0
157329 (2.9, 2.2)	8	nd	2	nd	0	nd	1	nd	1	nd	1	nd	0	nd	0	nd	nd
157330 (2.9, 2.3)	nd	6	nd	3	nd	0	nd	1	1	nd	1	nd	0	nd	1	nd	0
157331 (2.9, 2.2)	nd	5	nd	3	nd	0	nd	1	1	nd	1	nd	0	nd	1	nd	1*
157332 (2.8, 2.2)	nd	6	nd	3	nd	0	nd	1	1	nd	1	nd	0	nd	1	nd	0

\* minute spine-like bristle

† bristle broken off

Table 3. Number of bristles on endopodial joints of 2nd antennae of females. (nd—no data.)

Specimens	First joint				Second joint		Third joint		
	Proximal		Distal		Left	Right	Left	Right	
	Left	Right	Left	Right					
Adult females									
USNM 157334 (5.0, 4.0)	13	13	6	6	0	0	1	1	
157335 (5.0, 4.0)	12	nd	6	nd	2	nd	1	nd	
157336 (5.0, 3.9)	12	12	5	5	1	1	1	1	
157337 (4.9, 3.9)	12	nd	5	nd	1	nd	1	nd	
157338 (4.9, 3.9)	12	nd	6	nd	1	nd	1	nd	
157339 (4.9, 3.8)	13	nd	5	nd	0	nd	1	nd	
157340 (4.8, 3.9)	nd	9	nd	5	nd	0	nd	1	
A-1 females									
157341 (3.9, 3.2)	12	nd	5	nd	1	nd	1	nd	
157342 (4.0, 3.1)	nd	12	nd	5	nd	0	nd	1	
157349 (4.0, 3.1)	nd	8	nd	5	nd	0	nd	1	
157350 (4.0, 3.2)	9	nd	4	nd	0	nd	1	nd	
157353 (4.0, 3.2)	nd	10	nd	4	nd	0	nd	1	

identifying the A-3 instar as a male, because the long bristle of the 3rd joint is terminal on the female.

The endopodite of the A-2 male bears 7-11 short proximal and 3 or 4 short distal bristles on the 1st joint, no or 1 distal bristle on the 2nd joint, and 1 long proximal and 1 short spinelike bristle on the 3rd joint (Fig. 7d). The 3rd joint on the A-2 instar is much longer than that joint on the A-3 instar relative to the 1st and 2nd joints.

The endopodite of the A-1 male bears 6-11 short proximal and 3-5 short distal bristles on the 1st joint, 4 or 5 short distal bristles on the 2nd joint, and 1 long proximal and 1 minute spinelike terminal bristle on the 3rd joint (Fig. 7e). The length of the 3rd joint of the A-1 male is about 65% of the combined length of joints 1 and 2, compared to about 48% on the A-2 male. The length of the 3rd joint of the A-1 male is about 80% of the length of the long proximal bristle compared to about 38% on the A-2 male.

The endopodite of the adult male bears 6-12 short proximal and 4-6 short distal bristles on the 1st joint, 8 or 9 short distal bristles on the 2nd joint, and a medium length (2 or 3 times length of short distal bristles on 2nd joint) proximal bristle on the 3rd joint (Fig. 7f). The 3rd joint is reflexed on the 2nd, its tip is pointed, and it bears serrations along the inner margin. The function of the endopodite of the adult male is to clasp the female during copulation.



Endopodite of female 2nd antenna (Table 3): The morphology of the joints and the position of the bristles is similar on the endopodites of the instars and on the adult, but the number of bristles on the 1st and 2nd joints differ. The 3rd joint always bears a long terminal bristle. The endopodite of the A-1 female bears 8–12 short proximal and 4 or 5 short distal bristles on the 1st joint and no or 1 short bristle on the 2nd joint (Fig. 7a). The adult female bears 9–13 short proximal and 5 or 6 short distal bristles on the 1st joint and no or 1–2 short bristles on the 2nd joint (Fig. 7b).

Distal bristles on dorsal margin of basale of maxilla (Table 1): The basale of the A-3 male bears 4 or 5 distodorsal bristles, the A-2 males 6, the A-1 male 7 or 8, and the adult male 7 to 9. The basale of the A-1 female bears 8 distodorsal bristles and the adult female 10 to 12.

*Remarks concerning Cycloleberis galathea* Poulsen, 1965.—Poulsen (1965:260) described this species from 2 specimens, an A-1 female (holotype) from False Bay, South Africa, and a juvenile male paratype (A-1 or A-2 instar) from Beira, Mozambique. The 1st endopodial joint of the 2nd antennae of the female bears 2–3 proximal bristles (Kornicker, 1975:13), whereas the 1st endopodial joint of the 2nd antennae of the juvenile male bears 10 proximal bristles. The variability of the number of bristles on the 1st endopodial joint of the 2nd antenna has been studied for *Cycloleberis squamiger* (Scott, 1894) by Kornicker (1975:14, Table 1) and for *C. christiei*, herein (Tables 2, 3). Extrapolating these data to *C. galathea* we conclude that the female and male referred to that species by Poulsen are not conspecific. The juvenile male from Mozambique is referred herein to *C. christiei*, but only questionably, because the distal dorsal margin of the basale of the maxilla of the Beira specimen bears only 4 bristles compared to 6 on the A-2 male and 7 or 8 on the A-1 male of *C. christiei*. More specimens from the vicinity of Beira will have to be studied before the identity of the species of *Cycloleberis* living there can be known with certainty.

*Comparisons.*—The comb of the 5th limb of the adult male of the new species, *C. christiei*, differs from that of *C. squamiger* in not having a rounded protuberance anterior to the middle process on the dorsal margin and, also, in not having an internal sclerotized structure. The A-1 female of *C. christiei* differs from the A-1 female of *C. galathea* in having 8–12 proximal bristles rather than 2–3 (Kornicker, 1975:13) on the 1st endopodial joint of the 2nd antenna, and in having more than 4 distal bristles on the dorsal margin of the basale of the maxilla. The sensory bristle of the 5th limb of the 1st antenna of the A-1 female of *C. christiei* bears 2 short proximal filaments compared to 3 on the sensory bristle of the A-1 female of *C. galathea*, but the variability of this feature is not known. The adult female of *C. christiei* bears 9–13 proximal bristles on the 1st endopodial joint of the 2nd antenna compared to only 1–4 bristles in this place for *C. squamiger*.

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